USAFETAC/TN--92/001

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CAPABILITIES, PRODUCTS, AND SERVICES OF USAFETAC

USAF
ENVIRONMENTAL TECHNICAL
APPLICATIONS CENTER

JUNE 1992

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Scott Air Force Base, Illinois 62225-5438

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15 June 1992

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PREFACE

This technical note describes the capabilities, purpose, and organization of the United States Air Force Environmental Technical Applications Center (USAFETAC), the Air Weather Service unit charged with building, maintaining, and applying the United States Air Force's climatic database.

USAFETAC is located at Scott Air Force Base, Illinois. Its Operating Location A (OL-A), collocated with the National Climatic Data Center at Asheville, North Carolina, maintains the Air Force's climatic computer database as part of the Federal Climate Complex. USAFETAC analysts apply the contents of the total database to satisfy specific customer needs upon request.

The computer database maintained by OL-A at Asheville is in the same building as a civilian version maintained by the National Climatic Data Center. Both databases were built from weather observations collected, in some cases, for over a period of more than a hundred years. The databases are continuously updated through electronic input from worldwide sources.

The purpose of this document is to familiarize potential USAFETAC customers throughout the Department of Defense with USAFETAC and its capabilities. It begins by describing some of USAFETAC's products and services and tells potential customers how to obtain them. Most USAFETAC services are requested in accordance with AFP 105-18 (*Air Weather Service Centralized Support System)* and DA Pamphlet 115-1 (*Requests for Climatological Support to Army Activities*). After describing the contents of USAFETAC's climatic database, its computer assets and its organization are discussed briefly. An appendix provides a history of USAFETAC and of military climatology.

Because weather has affected virtually every military operation in history, planners and operational specialists at all levels should find something of interest here. Those who have used USAFETAC in the past should take a careful look at the new capabilities listed. Technological advancements in the past few years have resulted in a number of new climatological data applications not thought possible earlier.

For information, call or write:

USAFETAC/DO, Scott AFB IL 62225-5438

DSN 576-4024

Commercial (618) 256-4024

FAX 576-3772 (DSN)
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Chapter 1

USAFETAC PRODUCTS AND SERVICES

The following partial listing of USAFETAC's products and services should give potential customers at least some small idea of our nearly limitless capabilities. Most of the products and services listed here can be modified or tailored to meet unique or specialized requirements. To discuss *your* requirements, call USAFETAC/DO, DSN 576-4413/4024.

Aerial Spray Analysis

This PC version of the Forest Service (Cramer-Barry-Grim) Aerial Spray Computer Model is used to predict aircraft spray dispersion and deposition over a given area. Some applications include design optimization of spray concentrations, optimum flight and meteorological conditions for spraying, and assessment of potential environmental impacts.

Atmospheric Profiles

Our analysts can prepare a detailed atmospheric analysis for any predefined atmospheric segment of the world, for a specified time in the recorded past, from the surface to 400,000 feet. These analyses include vertical or slant-range profiles of wind, temperature, absolute humidity, density, pressure, and precipitable water. Profiles also provide gridded cloud depictions, site weather pseudo-surface observations, 24-hour weather history, and aerosol variables. These vertical profiles are produced by the AWS Atmospheric Slant-Path Analysis Model (ASPAM).

Atmospheric Stability Summaries

Our empirical program uses surface observations to calculate the Pasquill classes (A-F) by hour and month, where A indicates strong convection, D represents purely mechanical turbulence, and F implies stable air in which mechanical turbulence is strongly damped by stratification.

Bibliographies

With access to more than 400 on-line computer databases, USAFETAC can provide requesters with bibliographies that cite currently available references on a given subject in the atmospheric sciences and related disciplines.

Database vendors include DIALOG, CIRC II, and the Defense Technical Information Center (DTIC). We also have a secure terminal on the Defense Research Development Test and Evaluation (RDT&E) Online System (DROLS), which contains more than 1 million citations on DoD scientific and technical documents.

"Subject" bibliographies (SBs) are prepared ad hoc on one subject, for one requester. "Current awareness" bibliographies (CABs) are prepared periodically to provide one or more requesters with recent additions to the literature on a specific subject or discipline.

Climate Forecast Model

We can provide outlooks of seasonal temperatures (above, below, or "normal") 3-12 months in advance with a 1978 version of the Scripps Oceanographic Institute model based on best matched seasonal analogs of sea-level pressure over the North American and European continents. The seasons compared are 1899 through the present.

Climatic Summaries

USAFETAC routinely produces a number of standard climatic summaries, including the following:

- **Surface Observation Climatic Summaries (SOCS).** The SOCS replaced the Revised Uniform Summary of Surface Weather Observations (RUSSWO) in July 1988. Each SOCS summarizes hourly observations (and "summary of day" data) for a given weather station. Five years of record are required to create a SOCS. Existing SOCS are updated whenever 5 additional years are added to the database. SOCS summarize observed data in eight categories: atmospheric phenomena; precipitation; wind; ceiling, visibility and sky cover; temperature and humidity; pressure; crosswinds; and degree days. Each SOCS includes a Climatic Brief, described below. SOCS are published as USAFETAC data summaries and are available in paper or microfiche.

- **Climatic Brief.** A two-page summary of monthly and annual climatic data for any station with a SOCS; collected and published as *Station Climatic Summaries*, a seven-part series that comprises North America; Latin America; Europe; Africa; Asia; Antarctica, Australia, and Oceania; and USSR, Mongolia, and China. The publications also include collections of the OCDSs described below.

- **Operational Climatic Data Summary (OCDS).** A summary of monthly and annual climatic data prepared manually when the creation of a standard computerized "climatic brief" is impractical because of the type of data available (for example, no "summary of day" information, 3-hourly data only) or to answer a short-notice request. The most recent 10-year period of record is used unless more is available. Data is supplemented from other sources such as earlier periods of record, data from contemporary and/or earlier stations, and published data from other sources. All sources are given in the legend.

- **Temperature/Dew-Point Change Summaries.** These provide monthly summarized temperature and dew-point changes by hour, stratified by ceiling and wind, for stations from which surface weather observations are available. Data is provided in monthly increments. Four wind sectors, three wind speed classifications, and up to five ceiling categories may be stipulated by the customer. Values are displayed in tabular and graphic form. The product is used primarily as a forecaster aid (see 5WW-TN-72-1, *The Use of Diurnal Temperature and Dew Point Curves*) and in systems development when temperature and/or humidity variation is important. These summaries are available as computer printouts or in microfiche.

- **Wind-Stratified Conditional Climatology Tables.** These monthly tables give percent occurrence frequencies of past hourly weather observations for specified weather categories of ceiling or visibility stratified by surface wind direction and valid for 1 to 48 hours from the initial weather condition. See 5WW-TN-78-1, *The Use of Wind Stratified Conditional Climatology Tables*.

- **Crosswind Summaries.** These give percent occurrence frequencies for specified crosswind components based on hourly observations. Categorical ceiling/visibility constraints are included. The content and basis for each summary is clearly described in each product. Crosswind summaries have been a part of each SOCS since July 1988.

- **Heating and Cooling Degree-Day Summaries.** These monthly tables are computed by determining the difference between daily mean temperatures and 65° F (or another base temperature determined by the customer), then summing these differences for each individual month. For calculating degree-days, the daily mean temperature is normally defined as the sum of the daily maximum and minimum temperatures divided by two. The use of other mean temperature definitions is identified in individual summaries. A modified version of these summaries has been a part of each SOCS since July 1988.

- **Temperature Duration Summaries.** These can be for high or low temperatures. They have been used in applications such as the determination of battery life.

- **Precipitation Summaries.** These provide climatological precipitation amounts for every week of the year. They can be used in combination with temperature to determine the best times to use heavy equipment with the least damage to roads and grounds.

- **Daily Temperature/Precipitation Summaries.** These give maximum/minimum and mean maximum/minimum temperatures, degree days, maximum and mean precipitation, and maximum and mean snowfall for every day of the year during a specified period of record. Mean precipitation and snowfall are based only on days in which precipitation and snowfall actually occurred; the number of years of precipitation or snowfall for each date is given.

- **Cloud Data Summaries.** These include cloud amount distributions of total cloud, cloud cover (low, middle, or high) within various layer combinations; frequency of occurrence of clear skies; and frequency of less than a specified cloud amount above or below various heights. Distributions of total cloud cover versus maximum cloud tops and frequency of occurrence of consecutive grid points along a specified great circle route having specified cloud cover are also included. Monthly summaries for available analysis hours can be prepared for any point, anywhere in the world.

Cloud-Free and Clear Line-of-Sight (CFLOS and VCLOS) Probabilities

Static CFLOS probabilities for various look-angles can be produced for specified locations by using cloud cover distributions from surface observations or AFGWC cloud analyses using the Standard Research Institute (SRI) CFLOS Model. USAFETAC also has a visible clear-line-of-sight (VCLOS) model that estimates environmental effects on sensors operating at visible light frequencies, such as those in the TV Maverick and TV GBU-15. Input data consists of surface weather observations, NEPH cloud fields, date, time, locations, attack geometry, and target/background albedos. Data can be processed for single case and climatological studies and used to evaluate the effectiveness of electrooptical systems. See also our CFLOS simulation capabilities described on Page 13.

Descriptive Climatologies

These narrative studies (prepared on request for regions, areas, or points) are written to the customer's order. Studies include descriptions and effects of synoptic climatology on the point or region studied. The emphasis is on typical daily weather scenarios and their causes. Studies can be prepared to cover events that, while rare, may still affect mission success drastically. A typical study, for example, might discuss the occurrence of dust storms that restrict visibility to less than 1/2 mile in a

region or at a point during a specific time period. According to the needs of the customer, narrative studies are typically produced in one of three packages:

- **Point/Small Area Climatologies**. These site-specific climatologies are for areas smaller than Connecticut and for operations below 5,000 feet above ground level (AGL). They can be prepared for specific time periods. They usually take from a week to 3 months to complete, but high-priority projects covering time periods of a month or less can be turned out in less than 72 hours.

- **Large (Intermediate) Area Climatologies.** These studies describe areas larger than the point/small area--the Persian Gulf is an example. They place more emphasis on mean low-, middle-, and upper-level features. They may be seasonal or annual. These studies generally take from 3 to 12 months.

- **Regional Climatologies** cover portions of one or more continents, typically for periods of an entire year. These studies provide detailed discussions of major meteorological and climatological regimes, with emphasis on the interaction of semipermanent climatic controls responsible for seasonal weather patterns. Mean temperature profiles are provided from surface to 30,000 feet. Regional studies may take from 12 months to 2 years.

Electrooptical (EO) Climatology.

We have adapted the LOWTRAN7 model to use conventional databases in generating electrooptical transmittance climatologies in selected wavelength intervals, such as the 8-12 micron band for infrared systems. A "driver" program was developed to read conventional surface data for input into LOWTRAN7 and selection of the aerosol model to be used. We also developed a program that reads conventional upper-air data and creates input cards for FASCOD2, the model used to compute transmittance for laser-guided munitions. Our EOCLIMO microcomputer program provides station-specific transmittance climatology in an interactive format. The latest version (2.0) provides monthly transmittance climatology for individual stations at 3-hour intervals. For some regions of the world, a brief descriptive narrative accompanies the statistical data for each station. The program also generates a map of available stations, along with joint probabilities of user-defined transmittance and ceiling thresholds.

Engineering Design and Construction Studies

Standard engineering design data packages include temperature, precipitation, icing, and extreme wind analyses. Crosswind studies for runway orientation, along with meteorological data and climatological narratives for inclusion in base master or comprehensive plans are also available. We also provide design freezing index and other data for pavement evaluation studies. We can now provide pavement temperature studies, which see. We provide engineering design and meteorological data for the USAF Base Master Plan, Tabs A and D, as well as the data for *Engineering Weather Data*, the Tri-Service manual.

Environmental Simulation

When real weather data is inadequate or not available for use in operational simulations, war-gaming, or weapons systems effectiveness studies, *simulated* weather observations may be the answer. USAFETAC has developed a number of sophisticated techniques that provide simulations for single stations or for large arrays of statistically correlated points. These techniques include:

- **Ceiling and Visibility (MODCV).** We've modeled ceiling and visibility climatology for more than 600 stations worldwide. The latest version (MODCV 4.0) runs on IBM-compatibles. It requires CGA or better and DOS 3.2 or better. MODCV displays conditional and unconditional climatological probabilities of selected ceiling and visibility thresholds out to 72 hours. Improvements over previous versions include better graphics and the addition of data for limited duty stations.

- **Ceiling and Visibility (CVOF).** The CVOF model is a state-of-the-art simulation model that generates ceiling and visibility observations and forecasts. The observations have the proper spatial and temporal correlation. The forecasts are designed to show the same skill as the AWS average for ceiling and visibility forecasts.

- **Cloud-Free Line-of-Sight (CFLOS).** We've developed several CFLOS simulation models. One tabulates a climatology of CFLOS statistics based on a ground-based view of orbiting or geostationary satellites. It is capable of handling several sites simultaneously to produce joint-site CFLOS probabilities. Another simulator (CLDGEN) creates cloud scenes as if they were observed by someone on the ground. It can be used to estimate the probability of a cloud-free arc for a specified duration. Another model (C_CLOUD_S) provides cloud-cover distribution statistics and CFLOS probabilities for any point on Earth. Output applies to space- or earth-based viewing.

Exercise Support

We provide tailored climatological support with products that range from weather impact indicators to en route winds for all DoD exercises, major or minor.

Heating and Cooling Data

USAFETAC offers a wide range of heating/cooling data, which includes:

- Heating and air conditioning design and criteria data (AFM 88-29).

- Heating and cooling degree-day statistics.

- Computerized Energy Analysis Reference Year (CEARY) data for use in building-load analysis. CEARY data is from 12 months of specially selected surface observations for each location. Direct, diffuse, reflected, and total solar irradiance are calculated from weather elements and added to each observation.

Illumination Data

Two USAFETAC microcomputer programs (LIGHT and LIGHTPC) compute solar and lunar variables such as the beginning of nautical twilight, ending of civil twilight, percent lunar illumination, length of darkness, etc., for any location (input latitude and longitude), for any day/month/year in the future. Algorithms to compute solar declination, azimuth, etc, are self-contained. The latest version no longer requires annual database updates and includes TAC's specified illumination thresholds for night vision goggle training.

Information Scouting and Acquisition

USAFETAC continually improves and enlarges its library collections by actively identifying and acquiring new scientific and technical documents (particularly those from sources outside the United States).

Journal Accessions Lists (JALs)

JALs are lists of articles in recent journals (magazines) received by the AWSTL. They are published and distributed quarterly to make

recipients aware of recent scientific and technical articles and make it possible to order copies. JALs are produced on topics that include atmospheric physics, space, atmospheric sciences, meteorology, statistics and mathematics, climatology and forecasting, and general topics.

Lightning Climatology

We can provide lightning data climatology for any given area in the CONUS. The data can include monthly and diurnal frequency of cloud-to-ground lightning, duration of lightning events, or an areal display of lightning strike frequency. We're developing a microcomputer program that will let the user display summarized lightning data for areas of 10,000 square miles across the CONUS--it should be available by June 1993.

Low-Level Route Climatology

We can provide interactive microcomputer programs that provide worst-case route climatology for low-level refueling or training routes. Entry, turn, and exit points are entered by the user.

Mission Success Indicators (MSI)

Our program computes percent occurrence frequencies with respect to time, the number of days a specific weather event occurred, or the start-stop date-time groups with duration in hours, of any weather or combination of weather elements in the DATSAV surface database.

Pavement Temperature Summaries.

Using a model provided by the Air Force Civil Engineering Support Agency, we can provide runway pavement temperature data for varying depths and types of runway surface.

Post-Event Analysis

We can provide observational data, AFGWC analyses, and other published information for specific locations (from days to years in duration) to answer questions related to specific events.

Pressure Reduction Ratios

Pressure reduction ratios ("*r*" factors) are available on request for any Air Force or Air National Guard weather observing facility IAW Federal Meteorological Handbook No. 8, *Barometry*.

Rainrate Studies

These studies provide statistics on the effects of rain/atmospheric moisture on attenuation of radio wave propagation. Estimates of rain-event duration and rainrate frequency of occurrence for instantaneous rainrate thresholds are provided from a dataset that includes both instantaneous and clockhour rainrates. Rainfall statistics, along with cloud moisture and freezing level data, are used with state-of-the-art attenuation models to estimate the related attenuation of electromagnetic radiation.

Range Reference Atmosphere (RRA)

A "reference atmosphere" is a statistical model of the atmosphere derived from upper-air observations over a specific location. The atmospheric models developed for the Range Commander's Council/Meteorology Group (RCC/MG) are called "range reference atmospheres," or RRAs. An RRA is the authoritative source for upper-atmosphere climatology over the launch and/or recovery site for which it has been prepared. RRAs are used to plan, evaluate, and establish environmental launch constraints for aerospace vehicles launched from a particular location. RRAs contain tabulations of monthly and

annual means, standard deviations, and skewness coefficients for wind speed, pressure, temperature, density, water vapor pressure, virtual temperature, and dew-point temperature. They also provide means and standard deviations for zonal and meridional wind components and the linear (product moment) correlation coefficient between wind components. Statistical values are tabulated (at the station elevation) at 1-km intervals from sea level (MSL) to 30 km and at 2-km intervals from 30 to 70 km. Wind statistics begin at about 10 meters above station elevation and continue upward with respect to MSL thereafter. For ranges without rocketsonde measurments, RRAs terminate at 30 km; they may be extended upward when rocketsonde data from a nearby location can be made available.

Raytrace Diagnostic Models

The CLIMORAY model uses USAFETAC's upper-air database to generate height-error climatologies. The data is used to determine the most cost-effective way to provide environmental support to a new generation of air-search radars. A model under development will be used to determine optimum transmitter heights and minimize the effects of atmospheric refraction for balloon-borne radars.

Refractive Index Studies

These studies provide refractive index values and refractive gradients through the atmosphere. We can provide refractive climatologies for individual radiosonde stations as well as post-analysis of meteorological data to investigate anomalous radiowave propagation. We offer a PC program that displays different types of refractivity climatology for any upper-air station with a statistically significant number of observations. Several raytrace models are available for use in post-analysis studies. They have various capabilities that include graphic output, altitude error, laterally heterogeneous atmosphere (multiple soundings) and elevation angle errors. A climatological raytrace program produces a climatology of height error.

Simulation Support

Surface observations, cloud analyses, and various analyzed weather charts for selected scenarios are available for use in simulation studies. See Environmental Simulation.

Space Environmental Support System (SESS) Climatology

USAFETAC has developed techniques for providing statistical studies of the space environment. These studies include those that provide climatological distributions of data. Results are displayed in graphic or tabular format. Using SESS models with historical inputs, we can analyze past events such as satellite anomalies. Our ionospheric modeling capability has been improved. The updated version of the Ionospheric Conductivity and Electron Density (ICED) model provides state-of-the-art specifications of the mid-latitude ionosphere. The International Reference Ionosphere (IRI-90) model provides climatology of the ionosphere for nonauroral latitudes. Together, these models provide a means for performing ionospheric point analysis. The Wide-Band Scintillation Model (WBMOD) is available for analyzing trans-ionospheric communication anomalies.

Statistical Analysis System-generated Diurnal Curves

Curves such as the 99th, 95th, median, 5th, and 1st percentiles of temperature by hour by month are available.

Technical Publications

USAFETAC edits, publishes, distributes, and maintains AWS, USAFETAC, AFGWC, and

AFSFC technical reports, technical notes, forecaster memos, catalogs, project reports, users handbooks, and data summaries in a variety of media, including conventional paper, microfiche, computer, and CD-ROM. We also maintain copies of former AWS wing technical publications.

Uniform Gridded Data Fields (UGDF) Historical Data Grids

We can provide (from our archives, in UGDF format) weather-event scenarios for a given date or for a series of dates. The data consists of surface variables; low, middle, and high cloud type, amount, bases, and tops; and wind, temperature, dew-point temperature, and D-value for mandatory upper-air levels.

Upper-Air Descriptive Climatologies

Statistical summaries of means, extremes, etc., of user-selected atmospheric variables are available, along with estimates of "worst case" scenarios. The current menu now contains about 40 measured or derived meteorological elements from upper-air observations. These include various thermodynamic variables of pressure, temperature, moisture, and stability, along with wind speed, direction, wind shear values, and refractive coefficients. Users can specify starting and stopping elevations, as well as the increment, to study any layer of the atmosphere for which data is available. Graphics depicting the vertical profiles of statistical values can be generated for any of the available meteorological elements versus height. Windroses (graphic or tabular) can also be produced from user-specified upper-atmospheric levels.

Upper-Air Studies

We can provide specialized studies of such weather variables as upper winds, temperature, moisture, density, standard height levels, D-values, and wind shear (to include extreme values), on request. We can also provide probability ellipses for debris fallout and interlevel/intralevel correlations of winds.

Vector Wind Models

Although these models were originally designed to derive additional information for RRAs, they can be used independently. The software, based on the work of O.E. Smith of NASA, calculates a number of wind statistics based on an assumed bivariate normal distribution of the wind. Input consists of five variables: two means, two standard deviations, and correlation between the u- and v-wind components. The interactive program can answer a number of questions, such as "What's the probability of a wind speed greater than 50 knots?" or "What's the probability wind rose for a selected location at 10-km altitude?" A limited amount of graphics can be produced (see USAFETAC/PR-90/007).

Wet-Bulb Globe Temperature (WBGT) Climatologies

WBGT studies, most frequently used to determine the effects of heat stress on troops, are available on request.

Wind Duration Studies

Studies of wind duration and other wind variables, often useful for evaluating the feasibility and sizing of wind-powered generators, are available on request.

Chapter 2

HOW TO REQUEST USAFETAC PRODUCTS AND SERVICES

WHO IS ELIGIBLE?

- Department of Defense (DoD) agencies and their contractors.
- Other United States Government agencies.
- Other activities by special arrangement and in accordance with public law and DoD regulations.

REQUEST CHANNELS

Air Force and Army

Send requests to USAFETAC/DO through your weather support staff or staff weather officer. Units that do not have a staff weather officer contact USAFETAC directly. Address to:

USAFETAC/DO
Buchanan Street, Building 859
Scott AFB IL 62225
DSN 576-4024/4413 Fax 576-3772
Commercial (618) 256-4024/4413

Navy

Naval Service activities send *non-urgent* requests to USAFETAC through the NAVOCEANCOM regional center; send *urgent* requests direct to USAFETAC/DO.

Other DoD and U.S. Government Agencies

Send requests direct to USAFETAC/DO.

DoD Contractors

Send requests to USAFETAC/DO through your contract monitor.

Foreign Governments

Submit requests through your embassy to SAF/IADD.

REQUEST FORMATS

Placing your request in a standard format saves all of us time and effort and minimizes confusion. See Appendix A for the standard environmental support request format. Extra information is required in requests for Standard Summary Packages--see Appendix B.

TELEPHONE CONSULTATION

For unique or complex requests, preliminary telephone consultation with USAFETAC/DO or the Chief Scientist (DSN 576-4024/4413) is recommended and encouraged. These consults can save time, money, and effort by making sure both parties are aware of what is wanted, needed, and available.

RESPONSIVENESS

USAFETAC's response time, which ranges from hours for emergencies to years for extraordinary projects, depends on the degree of urgency, the requester's USAF precedence or Army Force Activity Designator (FAD), and the "Weather Priority" from AFP 105-18. All these are considered in prioritizing requests and placing them in the USAFETAC queue. The three degrees of urgency and the four weather priorities are listed below:

Degrees of Urgency

- **Emergency.** Requires support within 24 hours. Submit by telephone and confirm by message within 24 hours.
- **Quick-Turn.** Requires support within 24-72 hours. Submit by telephone, confirm by message.
- **Routine.** All other requests. Submit by phone, message, or letter. Confirm telephone requests by message or letter.

Weather Priorities (AFP 105-18)

Weather Priority 1

- Execution support for war and contingency plans
- Operational support to Special Strategic Programs
- Operational support to USAF Precedence 1-1 or Army FAD-1 programs

Weather Priority 2

- *Planning* support for any of the above.

Weather Priority 3

- Operational support to deployments, JCS exercises, MAJCOM exercises, or major Army exercises.
- Routine WWMCCS support
- Operational support to ORIs
- Operational support for C2 agencies to direct deployment or other air-ground operations in progress
- Direct support of tropical storm identification and location

Weather Priority 4

- All other operational and planning support
- Training support
- Travel and VIP support
- Support to civilian contractors and other DoD agencies

PROJECT LIFE CYCLE

Upon receipt of your request for environmental support, the USAFETAC Operations Division (DO) reviews it, assigns a USAFETAC priority 1-8 (as shown in the following matrix), and passes it to an office of primary responsibility (OPR). According to the assigned priority, the OPR begins work on the project and continues until completion. *Note:* certain USAF precedence and Army FAD codes often result in the assignment of higher USAFETAC priorities than shown.

USAFETAC Priority Matrix

AWS Priority	USAF Precedence	Army FAD	USAFETAC Priority
1	---	--	1
2	---	--	2
3	---	--	3
4	1-1 to 1-5	I	4
-	2-1 to 2-10	II	5
-	3-1 to 3-10	III	6
-	4-1 to 4-10	IV	7
-	5-1 to 5-10	V	8

Projects requiring extraordinary resources are reviewed by a USAFETAC project board for modification (if necessary), and reentry into the queue. If the board determines that the project is beyond USAFETAC's capabilities, it may be referred to HQ Air Weather Service as a requirement that cannot be met.

When a project is completed, the OPR quality controls and corrects the final output, sends it to the customer, and notifies DO, who closes the project and prepares a request for feedback (an evaluation questionnaire) to be mailed to the customer. We ask that customers provide a frank appraisal of USAFETAC services in the questionnaire, ***with emphasis on how we affected your operations.*** We need and use your feedback to improve the way we do business.

REQUESTING USAFETAC STANDARD SUMMARY PACKAGES

The USAFETAC Standard Summary Package consists of a SOCS (Surface Observation Climatic Summary), WSCC (Wind-Stratifed Conditional Climatology) tables, an Hourly Temperature/Dew-Point Change Summary, and a Climatic Brief. These packages are produced on request. Use the format shown in Appendix A, but be sure to include all the information requested in Appendix B.

REQUESTING LIBRARY SUPPORT

The Air Weather Service Technical Library (AWSTL), an integral part of USAFETAC, is an officially designated USAF library (FL4414). The AWSTL is the only library in the DoD that is dedicated to the atmospheric sciences, and one of two in the entire Federal Government. The AWSTL collections comprise some 250,000 documents, including monographs, technical reports, research papers, theses, journals, and summarized climatological data in multimedia. Because it is an official Air Force library, the AWSTL's services are available to all DoD agencies and DoD contractors. Direct contact is authorized. Simple initial library support requests may be made by phone (DSN 576-5023/2625/4044), but requests for more complicated services, such as bibliographies or extended literature searches, should be in writing--see the suggested format in Appendix C. Mail or fax (576-3772) requests to AWSTL (FL4414), Scott AFB, IL 62225-5458.

Chapter 3

THE USAFETAC CLIMATIC DATABASE

THE DATABASE

The USAFETAC climatic database, created and maintained by OL-A at Asheville, is subject to continuous monitoring and quality control. The data it contains is as comprehensive and accurate as we can make it. Because the application and use of this data (mostly "raw" or unprocessed) requires considerable meteorolological skill and experience, we generally discourage its unconditional release to agencies outside USAFETAC. Even USAFETAC analysts who use the data routinely (almost all of whom are meteorologists) occasionally confer with the dataset specialists at OL-A before attempting to use it in a specific application. USAFETAC also has access to the National Climatic Data Center (NCDC) climatic database, the civil counterpart to the collocated USAF version.

DATABASE CONTENTS

The USAFETAC database contains more than 40 subsets of related data. Some of the best known of these are listed below. Most are described in detail in USAFETAC/TN-86/003, *Directory of Climatic Databases Available from OL-A, USAFETAC*. In addition to the commonly used databases (or datasets) listed here, USAFETAC has produced hundreds of others to fulfill special customer needs; although these remain available, they are not advertised for general use. Customers with unique requirements need only describe those requirements in their initial request for USAFETAC services--see Chapter 2. In consultation with the customer, we will determine the best way to satisfy these requirements by developing a new customized dataset or by modifying an existing one. The following are examples of frequently used databases/datasets; periods of record vary and are subject to change.

AWS Master Station Catalog

The catalog lists weather stations worldwide (with location, elevation, and current reporting status) that now transmit (or have transmitted since January 1977) surface and upper-air observation, radar observations, or forecasts.

Summary of Day (TDF-34)

Daily weather element summaries for about 1,800 stations, mostly U.S. Periods of record vary, but some go back to 1890. Elements included are maximum, minimum, and mean temperature; precipitation, snowfall, snow depth, peak wind, and the number of days on which specified atmospheric phenomena, such as rain, snow, fog, dust, and haze occurred.

Station File

These weather station datasets consist of surface observations from the mid-1930s to the present. They include elements such as wind, pressure, temperature, cloud, visibility, and weather. These files have undergone the most rigorous quality control available.

Real-Time Nephanalysis (RTNEPH)

Global analyses (on an eighth-mesh polar stereographic grid) of cloud and weather data from conventional surface and satellite observations since January 1984. Data includes present weather, visibility, and total cloud coverage, along with cloud type, base, top, and coverage for each of four floating layers. RTNEPH replaced 3DNEPH (below) in 1983.

3-Dimensional Nephanalysis (3DNEPH)

Global analysis (on an eighth-mesh polar stereographic grid) of cloud and weather information from conventional surface reports and satellite data from January 1973 to December 1983 (January 1977 to December 1983 for the southern hemisphere). Data includes present weather, low, middle, and high cloud type, minimum cloud base and maximum cloud top, total cloud coverage, and cloud coverage for each of 15 fixed layers.

DATSAV

In five parts, these datasets contain worldwide weather observations collected through the Automated Weather Network (AWN). Daily observations are decoded at AFGWC and transmitted to OL-A for storage on magnetic tapes. OL-A creates monthly and yearly DATSAV datasets from the following:

DATSAV Surface. Surface observational data (synoptic, airways, METAR, synoptic ship) from January 1973 to the present include such elements as wind, pressure, temperature, cloud cover, visibility, weather, and precipitation.

DATSAV Upper-air. Radiosonde, rawinsonde, pibal, and dropsonde observations from January 1973 to the present. Data includes wind, pressure, temperature, height, cloud, stability, thickness, and precipitable water.

DATSAV Aircraft. Aircraft observations from October 1975 to the present include wind, temperature, altitude, turbulence, cloud, icing, visibility, and radar data.

TSAV Rocketsonde. Rocketsonde observations from October 1975 to the present include height, temperature, pressure, wind, and density data.

DATSAV Satellite. Satellite observations from October 1975 to the present include height, temperature, and wind data from geostationary and polar-orbiting satellites.

High-Resolution Analysis System (HIRAS)

HIRAS replaced the Coarse-Mesh Upper-Air Analysis (below) in 1985. HIRAS is a global analysis of surface and upper-air data (on a 2.5 by 2.5-degree grid) compiled from conventional surface observations, upper-air soundings, and satellite data from January 1985 to the present. HIRAS includes wind, pressure, height, temperature, D-value, precipitable water, vorticity, and vertical velocity data for 16 levels from the surface to 10 millibars.

Coarse-Mesh Upper-Air Analysis

Consists of global upper-air analysis data on the whole-mesh grid, compiled from conventional surface reports, upper-air soundings, and satellite data from January 1977 to December 1984. It includes wind, pressure, temperature, D-value, and density data for 16 levels from the surface to 10 mb.

Snow/No Snow Analysis

Consists of analyses of the presence/absence of snow/ice on an eighth-mesh grid, excluding the tropics and ocean areas. Analyses are based on surface observations and satellite data collected since December 1975.

Surface Temperature Analysis

A global analysis (on an eighth-mesh grid) of surface temperatures compiled since April 1979. To produce this analysis, AFGWC uses surface observations of ambient air temperatures over land and sea-surface temperatures over water.

Terrain-Geography File

A global analysis (on an eighth-mesh grid) of geographical and terrain height data. It includes a geography indicator (water, ice, land, or coast), time zone indicator, and elevation.

USAFETAC now has a version of the Terrain-Geography file that gives probable aerosol type (rural, industrial, or maritime).

Space Environmental Support System (SESS) Climatic Database (SCDB)

The SCDB consists of solar optical, solar radio, ionospheric, magnetospheric, and satellite observations collected and compiled since December 1981. The most recent 3 years of the SCDB have been loaded into an on-line relational database for immediate access. The period of record for some data can be extended to 1976, giving USAFETAC the ability to analyze SESS data for an entire solar cycle.

Summarized Analysis Dataset

A summary of the Coarse-Mesh Upper-Air Analysis for each pressure level by year-month-day-hour from January 1977 to December 1983. It includes the summation, summation squared, and number of analyses used for each weather element. The product resulting from this dataset provides element means and standard deviations (coarse mesh) by month-hour.

Vandenberg Tower Database

Post-1985 Weather Information Display System data from Vandenberg AFB's micro-meteorological network of more than 20 tower-mounted sensors. Data includes 5-minute averages of wind direction, speed, temperature, pressure, and vertical temperature differential at elevations of 6, 12, 50, 100, 200, and 300 feet.

Lightning Database

This is one of our newest. It consists of cloud-to-ground lightning flash data across the CONUS from 1986 to 1990. Data includes flash location, number of strikes in a flash, polarity, and peak current. Although the lightning dataset is proprietary and not releasable outside USAFETAC, we can provide summaries that give temporal or spatial frequency of lightning flashes as they affect aircraft operations, space vehicle launches, and resource protection (See Chapter 1, "USAFETAC Products and Services").

Chapter 4

USAFETAC COMPUTER ASSETS

MAINFRAME COMPUTERS

USAFETAC operates two mainframe computers at Scott AFB: an IBM 3090-200E for unclassified work, and an IBM 4381 for classified. Both are in Scott's Consolidated Computer Facility, Building 1575. OL-A operates a UNISYS 2200.

IBM 3090 Mainframe (Scott AFB). The IBM 3090-200E dual processor (fed by 11 6250 BPI tape drives and two satellite link adapters) has 64 megabytes of main memory, 64 megabytes of extended memory, and 32 S10 channels. There are 195 gigabytes of online storage. A 3725 communications controller makes the 3090 accessible through 10 AT&T 60386 workstations, four IBM PS/2 McIDAS terminals and 44 IBM terminals. Output is through an eectrostatic graphics plotter, four remote printers, an STC 5000 high-speed printer, and a Postscript color printer. The IBM mainframe is also accessible through an all-purpose local access network of small computers available to USAFETAC analysts and other qualified users.

IBM 4381 Mainframe (Scott AFB). The IBM 4381 works off two 6,250 BPI tape drives. It has 25 gigabytes of on-line storage, 32 megabytes of memory, and operates at 6 MIPS. It is linked to the IBM 3090 by one-way secure communication. Access is through two terminals and output is by high-speed printer.

UNISYS 2200 Mainframe (OL-A). The USAFETAC climatic database is stored and manipulated on a UNISYS 2200 with 23.3 gigabytes of storage. The National Climatic Data Center (NCDC), collocated with OL-A at Asheville, operates a twin of the OL-A computer.

SMALL COMPUTERS

Access to the mainframes is provided by a local area network of small computers, along with a comprehensive collection of software that can meet virtually any customer requirement. USAFETAC's "dial-up" capability provides its customers direct interface with a wealth of information, including certain discrete environmental datasets.

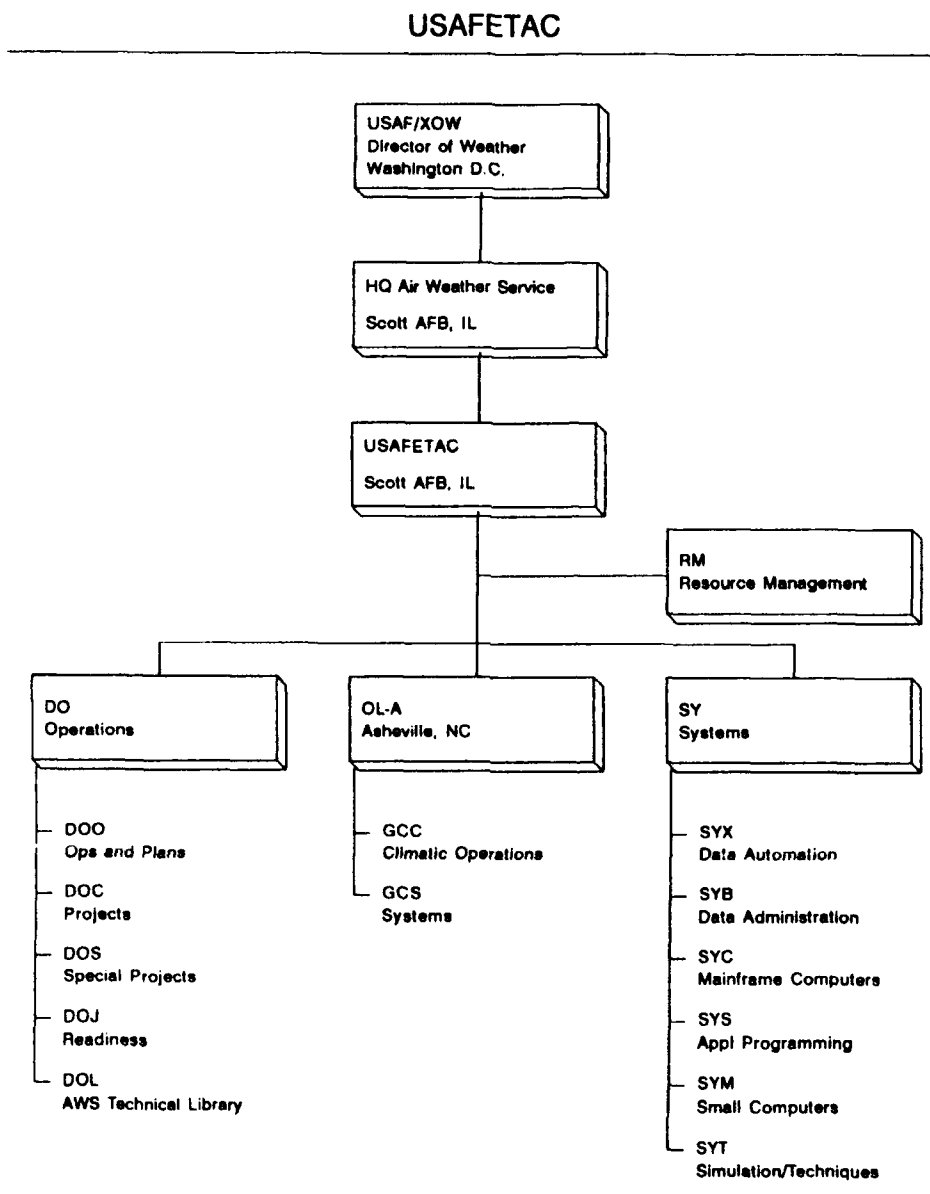

Figure 1. USAFETAC organization as of 1 July 1992.

Chapter 5

USAFETAC MISSION AND ORGANIZATION

MISSION

USAFETAC is an Air-Force controlled, named organization assigned to the Air Weather Service. After collecting and storing worldwide environmental observations, USAFETAC summarizes, analyzes and applies information from the resulting climatic database and other sources for Department of Defense (DoD) and other U.S. Government agency customers. Figure 1, opposite, shows USAFETAC organization as of 1 July 1992.

At Operating Location A (OL-A) in Asheville, NC, civilian technicians create and maintain the Air Force's computerized climatic database from environmental received from observing stations around the world through the Air Force Global Weather Central (AFGWC) at Offutt AFB, the Air Force Space Forecast Center (AFSFC) at Falcon AFB, and other sources. After quality-controlling these observations, OL-A summarizes and preserves the data as a permanent climatological record that it uses to produce standard summaries and other data to requesters.

At Scott AFB, a mixed force of military and civilian scientists and technicians use the climatic database (the second largest relational database in the Air Force), along with the vast information resources of the Air Weather Service Technical Library (AWSTL), to prepare environmental studies and analyses for DoD and other clients upon request. Tailored application of information in the database ranges from answers to simple requests for climatological probabilities to the very latest in environmental simulation studies.

PEOPLE

USAFETAC's manning authorizations include about 150 positions at Scott AFB and 85 at OL-A. The 120 civilian positions are distributed for the most part among weather technicians or meteorologists (at least 15 for advanced degrees) and computer specialists. Officer authorizations include about 35 for meteorologists with advanced degrees and five for PhDs. The 75 enlisted positions are more or less evenly distributed among the weather and computer specialties.

ORGANIZATIONAL RESPONSIBILITIES

USAFETAC is organized into four Divisions. The first, Resource Management (RM), provides the commander and staff with support services in the areas of personnel, manpower, organization, supply, budget, training, mobility, facilities, intelligence/security, and information management. The other three (Operations, Systems, and Operating Location A) interact with USAFETAC customers directly or indirectly. Each division is further organized into branches and teams of specialists that work together in satisfying customer requests.

Operations Division (DO)

The central point of contact for all USAFETAC support services. Supervises production of studies and analyses performed in response to requests from Army, Air Force, and other DoD organizations. Manages USAFETAC Crisis Action Team.

DOO--Operations and Plans

Receives, processes, prioritizes, and assigns taskings to satisfy customer support requests. Manages USAFETAC production. Maintains USAFETAC capabilities and requirements baselines; develops strategies to ensure that USAFETAC can support present and future requirements.

DOA--Projects

Uses the USAFETAC climatic database and data from other sources to analyze, simulate, and determine probabilities of environmental conditions and effects to support activities that include weapons system research and development, a variety of simulation activities, military construction projects, and planning for any environmentally dependent event.

DOS--Special Projects

Uses the USAFETAC climatic database and data from other sources to analyze, simulate, and determine probabilities of environmental conditions and effects to support classified programs and projects.

DOJ--Readiness

Researches existing literature and data to prepare regional, area, and point descriptive climatologies to meet specific customer-defined operational requirements.

DOL--AWS Technical Library

Provides specialized environmental library support products and services to DoD agencies that include USAFETAC, AWS, and AF weather units worldwide.

Systems Division (SY)

Plans and develops USAFETAC's scientific and technical capabilities; manages mainframe and small computer systems and operations.

SYX--Data Automation

Manages USAFETAC computer systems. Maintains computer configuration baseline; develops strategies to meet present and future computer requirements. Initiates and processes baseline changes. Monitors contracts.

SYC--Mainframe Computer Operations

Operates USAFETAC's mainframe computer.

SYM--Small Computer Operations

Designs, develops, evaluates, produces and maintains climatological software for small computers. Maintains local area network.

SYS--Applications Programming

Designs, develops, evaluates, produces, and maintains mainframe computer software.

SYB--Data Administration

Administers and maintains specialized computer databases; coordinates data interface requirements with outside agencies.

SYT--Simulation and Technology

Monitors the results of research in the environmental sciences; adapts promising scientific and technical modeling developments to meet identified AWS climatic support requirements.

Operating Location A (OL-A)

Manages the Air Force's climatological database. As a participating member of the Federal Climate Complex, maintains reciprocal agreements that make climatic databases available to other agencies. Organizes and maintains environmental datasets. Summarizes climatological data as standard and specialized products.

GCC--Climatic Operations

Creates and manages the climatological database; processes data into discrete datasets for specialized applications. Prepares standard and specialized climatic summaries. Arranges for Air Force access to the National Climatic Data Center (NCDC) climatic database.

GCS--Systems

Manages and operates OL-A's computers. Coordinates with NCDC in operating the joint USAF/NCDC computer facility. Designs and produces software used for processing climatology. Develops strategies to meet present and future computer requirements.

APPENDIX A

Environmental Support Request Format

Request USAFETAC services by letter/message/fax using this format:

1. ***Title of Request.*** Give exercise, operation nickname, or project title.

2. ***Unit supported.*** The unit that the requester supports; for example, "175 Composite Wing, Elmendorf AFB."

3. ***Priority.*** USAF precedence code or Army Force Activity Designator (FAD), and AWS priority. Include *degree of urgency* ("emergency," "quick-turn," or "routine").

4. ***How do you want the data delivered?*** Ordinary mail, express mail, message, fax, etc.

5. ***Address for response.*** To whom do you want the data sent? Give complete address.

6. ***Medium for Response.*** Specify paper, microfiche, floppy disk, etc. How many copies?

7. ***Message precedence and security classification.*** Specify precedence and classification for response.

8. ***Point of Contact.*** Give name, complete address and phone number of your point of contact for this project. Specify an alternate, please.

9. ***Specifics of Request.*** Tell us exactly what you need; for example, "Shemya percent occurrence frequency of: (1) ceilings less than 300 feet, (2) visibilities less than 1 statute mile, and (3) crosswinds greater than 30 knots for each month (all hours) and for all months." Include any other information (including environmental factors) we may need to fill the request. For example, "Shemya AB AK PASY, 52 42N 147 07E, elev 97 feet. Mag runway headings 104-284 degrees. Mag variation 3 degrees east, " or "The 175 Composite Wing has been asked to provide certain specific data that may have a bearing on a congressional subcommittee's decision to support Shemya's closure. The period of record should be at least 5 years, but 10 years is preferred. " Note the special information requirements for requesting standard summary packages--see Appendix B.

10. ***Suspense Date.*** Tell us when you need it. Describe the effect(s) on your mission (and on your customer's mission, if applicable) if we can't meet your suspense.

11. ***Justification.*** Tell us why you need it. Describe the effect(s) on your mission (and on your customer's mission, if applicable) if USAFETAC were unable to provide the requested services. If support is for a contractor, tell us (a) whether or not DoD has a contract obligation to provide the support and (b) what the penalties are if the support cannot be provided or is the suspense cannot be met.

12. ***Telephone consultations.*** If you have discussed this request with us previously, please describe those contacts here. Include dates, subject, participants.

APPENDIX B

Standard Summary Package Request Information

1. When requesting a SOCS, include the following:

Part A, Specified Atmospheric Phenomena Vs Wind Direction: Specify up to five wind direction sectors ("calm" and "variable" are included automatically). Sectors must not overlap; for example, use 260-349 and 350-019--not 260-355 and 350-0303.

Part B, Precipitation/Snowfall Tables: Specify inches or centimeters.

Part C, Peak Wind Tables: Specify knots or meters per second.

Part D, Ceiling Vs Visibility Summary: Specify visibility units as either statute miles or meters.

Part E, Summary of Day Temperature Tables: Specify Fahrenheit or Celsius.

Part G, Crosswind Summary:

- Specify magnetic heading for the primary runway.

- Specify *three* wind-speed thresholds. Since this summary includes gusts, standard thresholds are greater than or equal to 10, 15, and 25 knots.

2. When requesting WSCC Tables, include the following:

Visibility: Specify visibility units as statute miles, nautical miles, or meters.

Wind sectors: customers may specify up to six wind direction sectors, OL-A recommends using five or less, plus the "calm" and "All" categories. Too many sectors cause WSCC tables to be "overstratified," and lacking in statistical significance. For stations with data shortfalls and or periods of record shorter than 15 years, OL-A recommends using the smallest number of sectors that will meet operational requirements. Sectors must not overlap.

Ceiling/Visibility: Because of program limitations,, and to avoid overstratification, specify a maximum of six each ceiling and visibility categories. Stations that report in METAR code should specify visibilities in meters. If your station consistently reports "CAVOK," limit your highest ceiling category choices to 5,000 feet or less. The following are the standard categories given in AFR 105-2, *Operational Weather Support*;: Stations with different ceiling/visibility minimums may request additional categories to meet their requirements.

Ceiling Category	Visibility Category
A < 200 feet	J < 1/2 mile
B ≥ 200 feet but <1,000 feet	K ≥ 1/2 mile but < 2 miles
C ≥ 1,000 feet but <3,000 feet	L ≥ 2 miles but < 3 miles
D ≥ 3,000 feet	M ≥ 3 miles

APPENDIX B

Standard Summary Package Request Information, Cont'd

3. In requests for Hourly Temperature/Dew-point Change Summaries:

• Specify up to five ceiling categories; standard categories are:

< 1,000 feet
≥ 1,000 feet but < 3,000 feet
≥ 3,000 feet but <12,000 feet
≥ 12,000 feet but <20,000 feet
≥ 20,000 feet

• Specify up to six wind direction sectors; note, however, that more than four sectors can decrease a sumary's usefulness because of overstratification. The four standard sectors are:

330-059 North
060-149 East
150-239 South
240-329 West

• Specify up to three wind-speed categories; the lowest includes "calm." Standard categories are:

Calm to < 5 knots
≥ 5 knots but < 12 knots
≥ 12 knots

NOTES

1. Although each of the components of a standard summary package is normally prepared at the same time, data shortfalls may occasionally make it necessary for OL-A to truncate or even eliminate one or more of those components. For example, there are some full-time stations for which "extremes" are not available and are not provided.

2. Whenever OL-A begins a routine update of a standard summary package, they send a criteria worksheet to the affected station. For those stations with serious data shortfalls and/or short periods of record, OL-A will suggest that category choices be limited to avoid overstratification and loss of statistical significance.

3. Ceiling categories for the WSCC and the Hourly Temperature/Dew-Point Change Summary should not normally be the same. When they are, the latter is seriously overstratified in the lower ceiling categories where, in most cases, fewer observations fall. This can also cause overstratification in the higher categories. For example, 3,000-foot ceilings should not be grouped with clear skies; the result would be underestimation of the maximum temperature. For the best definition of temperature change from insolation, clear skies and high ceilings should not be included with middle or lower ceilings.

APPENDIX C

AWS Technical Library Support Request Formats

Request library *reference services* on AWS Form 9, *Air Weather Service Technical Library Reference Services Request*; request *books and periodicals* on AWS Form 11, *Air Weather Service Technical Library Acquisition Request.* You may substitute letter or message for either, but use the following format:

1. ***Requester***. Give full name, office symbol, address, and telephone number.

2. ***Date Required.*** Please be realistic. Do not use "ASAP."

3. ***Requests for Reference Services.*** When requesting answers to reference questions, state the question(s) clearly and succinctly. It would help if you tell us how you plan to use the information. When requesting a bibliographic search:

- Specify "subject" or "current awareness" bibliography.
- Provide as narrow a topic for the database search as possible.
- Provide a general description of the purpose to which the bibliography is to be put.
- Provide as many keywords and terms (for use in the literature search) as possible.
- Give us a search time period; that is, how far back do you want us to search?
- Describe the geographical specifications; that is, countries, regions, and/or stations.
- If you already know of any expert sources, list them.

4. ***Requests for Books and Periodicals.*** Turnaround time for purchases varies with the type of purchase and current funding, but it is normally 6 to 12 weeks.

- *Book Requests.* Give full title, author(s), publisher, date of publication, and ISBN (International Standard Book Number). If we don't have the book for loan, we'll borrow it for you from another library. For purchase requests, we need full justification, including purpose, the effect(s) on your mission if you don't get the requested item, and the signature of the authorized requester.

- *Periodical Article Requests.* Give full titles of the article and the periodical, author, periodical date, and inclusive page numbers.

- *Periodical Subscription Requests.* Provide full title and ads or brochures, if available. We need the same full justification as for a book request.

APPENDIX D

A History of USAFETAC and Military Climatology

MILITARY CLIMATOLOGY. The paper punched card, developed by Herman Hollerith for use in the 1890 U.S. census, made the use of historical weather records a practical means for determining the probability of future weather events and patterns. The British used punched cards successfully in about 1920 to extract wind data from ships' logs and produce wind roses for ocean areas. The Dutch Meteorological Institute borrowed some of the British cards in 1922 and began their own weather analyses. Norway, France, and Germany followed. In 1927, the Czech meteorologist L.W. Pollak placed small and cheap punch machines of his own design in every Czech weather station; as each observation was taken, it was punched on a card that was sent to a central tabulating unit for summary and analysis. Although the equipment for gathering and tabulating weather data has changed since then, the basic process has not.

The United States, where the punched card originated, was late to join the Europeans in collecting and tabulating weather observations. Fortunately, one of the "make-work" projects of the mid-thirties resulted in a sizeable punched card climatic database. A 1934 Works Progress Administration (WPA) project resulted in an atlas of ocean climates, prepared by punching 2 million observations (taken from 1880 to 1933) onto cards and summarizing the results. Another 3 1/2 million observations were processed manually, a task that took 90 percent of the labor devoted to the entire project.

In 1936, the WPA also funded a project that resulted in the compilation and analysis of millions of surface and upper-air observations taken from 1928 to 1941. From this project came a number of climatological publications vital to the Nation's preparation for World War II.

USAFETAC IN WWII. The United States Air Force Environmental Technical Applications Center (USAFETAC) was born at Bolling Field on 10 September 1941 as the Army Air Forces Weather Research Center's Climatological Section. This was just a week after the U.S. Destroyer Greer was attacked by a German submarine off the coast of Iceland. The attack provoked President Franklin Roosevelt to announce that "From now on, if German or Italian vessels of war enter these waters, they do so at their own risk." An unofficial state of war with Germany and Italy existed from that day forward. Although there was strong pressure for neutrality, military visionaries had seen the need to prepare for war as early as 1937, when the Air Weather Service itself was founded.

By 1941, the U.S. Weather Bureau had already turned over most of its climatological records and facilities to the military. Most of the Weather Bureau's climatology had been produced by the depression-induced WPA projects mentioned earlier. Even so, military climatology had a long way to go, especially since the meterological offices of every major country in Europe had been analyzing the world's weather on punched cards long before World War II began in 1939.

The 7 December 1941 attack on Pearl Harbor moved the collection and application of weather statistics to a top-drawer priority overnight. With current weather and forecasts blacked-out in hostile areas, planners turned to the climatologists with their questions. Where should air bases be located? How should the runways be oriented? What areas should heavy armor avoid? What should specifications for fuels and lubricants be? How about specifications for landing mats, wires, buildings? What times, dates, and locations are best for amphibious landings? How about bombing weather? Prevailing winds aloft?

With the limited information at their disposal, military weather people worked around the clock to produce climatological summaries that helped provide answers to planners' questions. The Army Air Forces climatological effort continued to expand. In 1943, the USAAF Statistical Services Division (now USAFETAC's Operating Location A) was created at Winston-Salem, NC, to begin the routine storage and processing of military weather observations. There was probably no WWII operation, major or minor, that did not include a climatological input. The planning for every landing, mission, and offensive, including the D-Day invasion in 1944 and the atomic bombing of Japan required extensive climatological preparation.

POSTWAR USAFETAC. Although demobilization cut deeply into the Air Weather Service's wartime strength of nearly 19,000, the importance of climatology and its applications continued to be recognized. In early

1946, a Military Climatology Unit (the USAFETAC of its time) was established at Gravelly Point, VA. The USAAF Statistical Services Division that had taken over the processing and storage of military weather data in 1943 moved to New Orleans in 1946, where about 300 people punched weather observations onto cards and summarized them. A major postwar project was processing the "Kopenhagener Schlussel" deck of 7 million captured German punched cards containing weather observations taken during WWII in Europe and the Middle East. In 1948, the Military Climatology Unit (now a division) moved to Andrews AFB, with the well-known climatologist Dr Woodrow C. Jacobs as its Chief.

USAFETAC IN THE FIFTIES. A Climatic Center at Andrews AFB continued to provide climatological data applications under various designations throughout the decade, with particular emphasis on the war in Korea and the strategic buildup necessitated by the Cold War. In 1952, the Statistical Services Division moved from New Orleans to Asheville, NC, where it is today. In 1956, the first electronic computer (an IBM 705) was made operational at Asheville, signalling the end for the high-speed electronic accounting machines (mostly IBM) that had been used to process climatology since WWII. In 1959, IBM electronic accounting equipment installed at the Climatic Center allowed the processing of data directly from punched card to tape.

USAFETAC THROUGH THE SIXTIES. In July 1960, the Data Processing Division at Asheville began reporting to the Climatic Center. In 1964, an IBM 7040 computer was installed at the Climatic Center, now in Washington, DC, at the Navy Yard Annex. In December 1964, the Climatic Center was officially designated the "Environmental Technical Applications Center, USAF." Computer upgrades continued. OL-A bought a new IBM 705-III from the Department of Agriculture in 1965 and an IBM 7044 replaced ETAC's 7040 in 1966. In 1968, twin RCA Spectra 70/45 computer systems were commissioned at Asheville for joint use by OL-A (then ETAC's Data Processing Division) and the National Climatic Data Center (then the National Weather Records Center).

USAFETAC IN THE SEVENTIES. By 1972, OL-A's card-punching function had been all but eliminated[1]--as a result, manning dropped from about 200 to 122. A further RIF (reduction-in-force) brought OL-A's authorized civilian strength to 83; give or take a few slots, it remains at that level today. In 1975, USAFETAC's move to Scott AFB, Illinois, was finally completed after the Air Force won a long legal battle against opponents who wanted to keep the unit in Washington. The move, which took 13 months and put ETAC's project commitments about 2 years behind schedule, was declared complete on 31 October when the new PDP 11/45 and IBM 360/45 computers became operational in Building 859. In 1976, the AWS Library (a branch of USAFETAC that now maintains the largest atmospheric physics collection in the DoD, if not the world) was officially designated Air Force Library #4414, and named the "AWS Technical Library." In 1979, the twin RCA computers at OL-A/NCDC were replaced by UNIVAC 1100/10s. By the end of 1979, USAFETAC strength stood at 232, with 149 at Scott and 83 at Asheville. Demand for climatological service still exceeded capabilities; the decade-end project backlog stood at 49,799 man-hours.

USAFETAC IN THE EIGHTIES AND BEYOND. ETAC continued to exploit computer and electronic technology as its compute power expanded exponentially through the eighties and nineties. Today's climatologists and analysts continue to fulfill the same kinds of customer requirements that their predecessors handled 50 years ago, but with much-improved techniques and equipment. From a few microcomputers shared by eager analysts in 1980, USAFETAC now offers choices from among workstations linked to the mainframe computer and from a variety of stand-alone and networked microcomputers, all equipped with the latest software. After several permutations, USAFETAC's mainframe computer is now an IBM 3090 with 195 gigabytes (195 billion bytes) of storage.[2] At Asheville, the OL-A computer was upgraded to a UNISYS 2200 with 23.3 gigabytes of storage. Increased storage capacity and compute strength had been complemented by communications, most by direct satellite link.

1. USAFETAC's last punched card operation was not phased out until 1985.
2. The first USAFETAC computer, an IBM 705, had only 300 megabytes of storage.

GLOSSARY

Climatological Forecast A weather forecast based on the climate of a region rather than the dynamic implications of current weather; in essence, a statistical forecast. (Huschke, 1959)

Climatology The scientific study of climate. Includes the presentation of climatic data (climatography), the analysis of the causes of differences in climate (physical climatology), and the application of climatic data to the solution of specific design or operational problems (applied climatology). (Huschke, 1959)

Climate The long-term manifestations of weather, however they may be expressed. (Huschke, 1959)

Database A collection of data fundamental to an enterprise (Weik, 1977). Data organized for rapid search and retrieval. An example is the all-inclusive climatological database maintained by USAFETAC's OL-A. Many of the larger subsets of the USAFETAC database are also referred to as "databases."

Dataset A collection of similar and related data records recorded for use by a computer (Sippl, 1985). Unique combinations or aggregations of data elements; *subsets of a database.* Many subsets of the USAFETAC climatological database maintained by OL-A, especially those created for a specific requirement, are referred to as "datasets."

Gigabyte An amount of computer storage equal to *one billion* bytes or 1,000 megabytes. (Sippl, 1985)

Megabyte An amount of computer storage equal to *one million* bytes.

DISTRIBUTION

HQ AF/XOW, Pentagon, Washington, DC 20301-5000 1
HQ USAF/XOOCW, Washington, DC 20330-5054 1
OSAF/SS, Rm 4C1052, Pentagon, Attn: Weather, Washington, DC 20330-6560 1
USTC J3/J4-OW, Scott AFB, IL 62225-7001 1

AWS/XTX/DO/XT/SC/PM/RM, Scott AFB, IL 62225-5008 1
Det 3, DOXW, PO Box 95004, Henderson, NV 89009-5004 1
Det 4, AWS, Bldg 91027, Hurlburt Fld, FL 32544-5000 1
Det 5, HQ AWS, Keesler AFB, MS 39534-5000 1
OL-B, HQ AWS, Hanscom AFB, MA 01731-5000 1
OL-C, HQ AWS, Stop 16, Chanute AFB, IL 61868-5000 1
OL-K, HQ AWS, NEXRAD, 1200 Westheimer Dr., Norman, OK 73069-7902 1

HQ AFGWC/DO/SY/RM, MBB39, 106 Peacekeeper Dr., Offutt AFB, NE 86113-4039 1
OL-A, AFGWC, FLENUMOCEANCEN, Monterey CA 93943-5995 1
OL-C, AFGWC, NOAA NESDIS, Federal Bldg 4, Washington, DC 20233-0001 1
Det 7, AFGWC, Carswell AFB, TX 76127-5000 1
Det 11, AFGWC, Hickam AFB, HI 96853-5000 1
Det 40, AFGWC, APO AE 09494-5361 1

AFSFC/DOO, Stop 82, Bldg 715, Falcon AFB, CO 80912-5000 1
OL-A, AFSFC RE SE2, 325 Broadway, Boulder CO 80303-3328 1
Det 2, AFSFC, PO Box 2517, S. Hamilton, MA 01982-0517 1
Det 3, AFSFC, PO Box 261, Ramey Solar Obs, FPO AA 34050-0261 . . . 1
Det 4, AFSFC, Bldg 912, Holloman AFB, NM 88330-5000 1
Det 5, AFSFC, Hickam AFB, HI 96853-5000 1
Det 8, AFSFC, Unit 6270, PSC 55, APO AE 09605-5000 1
Det 9, AFSFC, PSC 465, Learmonth Solar Obs, FPO AP 96550-2910 1

USAFETAC, Scott AFB, IL 62225-5000 6
OL-A, USAFETAC, Federal Building, Asheville, NC 28801-2723 6
NCDC Library (D542X2), Federal Building, Asheville, NC 28801-2723 . . 1

AFSPACECOM/DOW, Stop 7, Peterson AFB, CO 80914-5000 1
1 CACS/DOW, Stop 4, Cheyenne Mt Complex, CO 80914-5000 1
50 OSS/WE, Stop 82, Falcon AFB, CO 80912-5000 1
45WS, Patrick AFB, FL 32925-6537 1
AFTAC/DOW, Patrick AFB, FL 32925-5000 1
730WS, Vandenberg AFB, CA 93437-5000 1
3 SSW/AMW, Stop 22, Peterson AFB, CO 80914-5000 1

SSD/MWA, PO Box 92966, Los Angeles, CA 90009-2960 1
SSD/IMO, PO Box 92960, Los Angeles, CA 90009-2960 1
SM ALC/LH-AWS, McClellan AFB, CA 95652-5609 1
USAICS, Attn: ATSI-CDW, Ft Huachuca, AZ 85613-6000 1
CSTC/WE, PO Box 3430, Onizuka AFB, CA 94088-3430 1
OD 4/DX, Onizuka AFB, CA 94088-3430 1
SSD OD 4, Onizuka AFB, CA 94088-3430 1
Det 3, SSD/WE, Stop 77, Buckley ANGB, CO 80011-9599 1
USAFA/DFP, Colorado Springs, CO 80840-5701 1
HQ AFSC/WE, Andrews AFB, MD 20334-5000 1
AFMC(1)/DOW, Wright-Patterson AFB, OH 45433-5000 1
FASTC/TAW, Wright-Patterson, OH 45433-6508 1
ASD/WE, Bldg 91, Wright-Patterson AFB, OH 45433-6503 1
WL/DOWA, Wright-Patterson AFB, OH 45433-6543 1
WL/DOW, Wright Patterson AFB, OH 45433-6543 1
PL/WE, Kirtland AFB, NM 87117-5000 1
RL/WE, Griffiss AFB, NY 13441-5700 1
RL/DOVL, Bldg 106, Griffiss AFB, NY 13441-5700 1
BMO/WE, Norton AFB, CA 92409-6568 1
AFESC/WE, Tyndall AFB, FL 32403-6001 1
AFESC/RDXT, Bldg 1120, Stop 21, Tyndall AFB, FL 32403-5000 1

ESD/WE, Bldg 1624, Hanscom AFB, MA 01731-5000 1
PL/TSML, Research Library, Hanscom AFB, MA 01731-5000 1
3246TW/DOW, Bldg 60, Rm 60, Eglin AFB, FL 32542-5000 1
WL/MN/WE, Eglin AFB, FL 32542-5000 1
AFDTC/WE, Eglin AFB, FL 32543-5000 1
AFFTC/WE, Edwards AFB, CA 93523-5000 1
510 OSS/WE, Bldg 1200, Edwards AFB, CA 93523-5000 1
6585 TG/WE, Holloman AFB, NM 88330-5000 1
SSD/SDW, PO Box 92960, Los Angeles AFB, CA 90009-2960 1
UTTR/WE, Hill AFB, UT 84056-5000 1
2849 ABG/DOW, Hill AFB, UT 84056-5000 1
2851 ABG/DOW, Bldg 1610, Kelly AFB, TX 78241-5000 1
2852 ABG/DOW, McClellan AFB, CA 95652-5987 1
2853 ABG/DOW, Robins AFB, GA 31098-5000 1
2854 ABG/DOW, L18, Tinker AFB, OK 73145-5000 1
USAFA/CWOSW, USAF Academy, CO 80840-5000 1
USCENTCOM/J3-W, MacDill AFB, FL 33608-7001 1
AFTAC/WS, Patrick AFB, FL 32925-5000 1
ESMC/WE, Patrick AFB, FL 32925-5000 1
OL-A, AFCOS, Fort Ritchie, MD 21719-5010 1
USAFALCENT RA, Pope AFB, NC 28308-5000 1
CCSO/FL, Tinker AFB, OK 73145-6340 1
304 ARRS/DOOR, Portland IAP, OR 97218-2797 1
OL-AW, SSD, Johnson Space Center, Houston, TX 77058-5000 1
AFOSR/NL, Bolling AFB, DC 20332-5000 1
TFWC/WE, Nellis AFB, NV 89191-5000 1
AFIT/CIR, Wright-Patterson AFB, OH 45433-6583 40
AF Ctr for Env Excellence (AFCEE), Brooks AFB, TX 78235-5000 1
Joint Svcs SERE Agcy, Ft Belvoir, VA 22060-5000 1

MAC/XOW, Bldg P40 N, Scott AFB, IL 62225-5000 1
438 OSS/WX, Bldg 1907, McGuire AFB, NJ 08641-5002 1
89 OSS/WXF, Andrews AFB, MD 20331-5000 1
437 OSS/WXF, Charleston AFB, SC 29404-5000 1
436 OSS/WXF, Dover AFB, DE 19902-5987 1
1605 MASS/WXF, APO AE 90820-5000 1
317 TAW/WXF, Pope AFB, NC 28308-5500 1
60 OSS/WX, Bldg P4, Travis AFB, CA 94535-5986 1
443 OSS/WXF, Altus AFB, OK 73523-5987 1
375 MAW/WXF, Scott AFB, IL 62225-5000 1
62 OSS/WXF, McChord AFB, WA 98438-5987 1
63 MAW/WXF, Norton AFB, CA 92409-5987 1
314 OSS/WXF, Little Rock AFB, AR 72099-5987 1
542 OSS/WXF, Kirtland AFB, NM 87117-5987 1
834 ABW/WXF, Hurlburt Field, FL 32544-5000 1
834 OSS/WXF, Hurlburt Field, FL 32544-5000 1
AFSOC/DOW, Hurlburt AFB, FL 32544-5000 1

ATC/DOW, Randolph AFB, TX 78150-5000 1
12FTW/DOW, Randolph AFB, TX 78150-5000 1
14FTW/DOOBW, Columbus AFB, MS 39701-5000 1
323OSS/DOW, Mather AFB, CA 95655-5000 1
640SS/DOBW, Reese AFB, TX 79489-5000 1
80FTW/DOOW, Sheppard AFB, TX 76311-5000 1
71OSS/DOW, Vance AFB, OK 73705-5000 1
100FTS/DOW, Williams AFB, AZ 85240-6497 1
47OSS/DOW, Laughlin AFB, TX 78843-5000 1
3380ABG/CXW, Keesler AFB, MS 39534-5000 1
815TAS/DOW, Keesler AFB, MS 39534-5000 1
3395TCHTS/TTMV, Keesler AFB, MS 39534-5000 1
Det 5, HQ AWS, Keesler AFB, MS 39534-5000 1
3340TCHTG/TTGU-W, Stop 16, Chanute AFB, IL 61868-5000 1
3800 ABW/OTW, Maxwell AFB, AL 36112-5000 1

30WS, Unit 15242, APO AP 96205-0015 1
CFA, C-2/SWO, APO AP 96258-0210 1
Det 2, 30WS, APO AP 96278-5000 1

8OSS/WX, APO AP 96264-5000 . . . 1
Det 15, 30WS, APO AP 96278-5000 . . . 1
OL-A, Det 15, 30WS, APO AP 96278-5000 . . . 1
Det 18, 30WS, Unit 15242, APO AP 96205-0015 . . . 1
OL-A, Det 18, 30WS, APO AP 96208-5000 . . . 1
OL-B, Det 18, 30WS, APO AP 96205-0015 . . . 1
Det 19, 30WS, Air Force Weather, APO AP 96271-0136 . . . 1
OL-H, Det 19, APO AP 96212-0138 . . . 1
Det 20, 30WS, Unit 15037, APO AP 96224-0216 . . . 1
OL-E, Det 20, 30WS, APO AP 96224-0217 . . . 1

PACAF/DOW, Hickam AFB, HI 96853-5000 . . . 1
Det 1, HQ PACAF, COMNAVMAR, PSC 489, Box 20, FPO AP 96540-0051 . . . 1
11WS, 6900 9th Ste 205, Elmendorf AFB, AK 99506-5000 . . . 1
3OSS/WE, Elmendorf AFB, AK 99506-5000 . . . 1
OL-D, 11WS, Galena APT, AK, APO AP 96510-2250 . . . 1
OL-I, 11WS, Unit 12524, APO AP 96513-2250 . . . 1
343OSS/WEA, 1215 Flightline Ave, Ste 2, Eielson AFB, AK 99702-5000 . . . 1
5073 ABG/WS, APO AP 96512-2250 . . . 1
Det 5, 11WS, Ft Wainwright AIN, AK 99703-5200 . . . 1
OL-A, Det 5, 11WS, Ft Richardson AIN, AK 99505-5290 . . . 1
375 OSS/WEF, Hickam AFB, HI 96853-5000 . . . 1
633 ABW/WX, APO AP 96542-5000 . . . 1
15 ABW/WE, Hickam AFB, HI 96853-5000 . . . 1
Det 7, 20WS, Wheeler AFB HI, 96854-5000 . . . 1
OL-A, Det 7, 20WS, APO AP 96556-5000 . . . 1
18 OSS/WE, APO AP 96386-5000 . . . 1
OL-A, Det 8, 20WS, APO AP 96376-1208 . . . 1
432 OSS/WX, Unit 5011, APO AP 96319-5000 . . . 1
OL-B, Det 17, 20WS, APO AP 96343-0085 . . . 1

SAC/DOW, Washington SQ, Ste 6, Offutt AFB, NE 68113-5000 . . . 1
22 OSS/DOW, March AFB, CA 92518-5000 . . . 1
15 AF/DOW, March AFB, CA 92518-5000 . . . 1
90 OSS/DOW, F.E. Warren AFB, WY 82001-5000 . . . 1
55 OSS/DOW, Offutt AFB, NE 68113-5000 . . . 1
93 OSS/DOW, Castle AFB, CA 95342-5000 . . . 1
92 OSS/DOW, Fairchild AFB, WA 99011-5000 . . . 1
301 OSS/DOW, Malmstrom AFB, MT 59402-5000 . . . 1
9 OSS/DOW, Beale AFB, CA 95903-5000 . . . 1
96 OSS/DOW, Dyess AFB, TX 79607-5000 . . . 1
5 OSS/DOW, 221 Flight Line Dr., Minot AFB, MD 58705-5021 . . . 1
384 OSS/DOW, McConnell AFB, KS 67221-5000 . . . 1
2 OSS/DOW, Barksdale AFB, LA 71110-5002 . . . 1
8 AF/DOW, Barksdale AFB, LA 71110-5002 . . . 1
42 OSS/DOW, Loring AFB, ME 04751-5000 . . . 1
416 OSS/DOW, Griffiss AFB, NY 13441-5000 . . . 1
380 OSS/DOW, Plattsburgh AFB, NY 12903-5000 . . . 1
97 OSS/DOW, Eaker AFB, AR 72317-5000 . . . 1
319 OSS/DOW, Grand Forks AFB, ND 58205-5048 . . . 1
28 OSS/DOW, Ellsworth AFB, SD 57706-5000 . . . 1
351 OSS/DOW, Whiteman AFB, MO 65305-5000 . . . 1
7 OSS/DOW, Carswell AFB, TX 76127-5000 . . . 1
410 OSS/DOW, K.I. Sawyer AFB, MI 49843-5000 . . . 1
305 OSS/DOW, Grissom AFB, IN 46971-5000 . . . 1
379 OSS/DOW, Wurtsmith AFB, MI 48753-5000 . . . 1

TAC/DOW, Bldg 21, Langley AFB, VA 23655-5524 . . . 1
24WS, Unit 0640, APO Miami 34001-5000 . . . 1
363 FW/DOMX, Shaw AFB, SC 29152-5070 . . . 1
363 FW/DOM, Bldg 1130, Shaw AFB, SC 29152-5410 . . . 1
OL-A, 363FW/DOMS, RFD 1, McEntire ANGB, Eastover, SC 29044-9690 . . . 1
4 OSS/OSW, Seymour Johnson AFB, NC 27531-6467 . . . 1
354 FW/WE, Myrtle Beach AFB, SC 29579-5000 . . . 1
23 FW/WE, England AFB, LA 71311-5000 . . . 1
31 OSS/OSW, Homestead AFB, FL 33839-5010 . . . 1
1 OG/WS, Langley AFB, VA 23665-5508 . . . 1
325 OSS/OSW, Stop 22, Tyndall AFB, FL 32403-5048 . . . 1
347 OSS/OSW, Moody AFB, GA 31699-5000 . . . 1
56 OSS/OSW, McDill AFB, FL 33608-5000 . . . 1
67 RW/DOM, Bergstrom AFB, TX 78743-5000 . . . 1
67 RW/DOMS, Bldg 207, Bergstrom AFB, TX 78743-5000 . . . 1
37 OSS/OSW, PO Box 4239, N. Las Vegas, NV 89030-1239 . . . 1
27 OSS/OSW, Cannon AFB, NM 88103-2705 . . . 1
35 FW/DOFW, George AFB, CA 92394-5000 . . . 1
355 TS/OSW, Davis-Monthan AFB, AZ 55707-6801 . . . 1
49 OSS/OSW, Holloman AFB, NM 88330-5000 . . . 1
58 OSS/OSSW, Luke AFB, AZ 85309-5000 . . . 1
OL-A 58OSS/OSW, Gila Bend AFAF, AZ 85337-5000 . . . 1
57 OSS/OSW, Nellis AFB, NV 89191-5000 . . . 1
366 OSS/OSW, Mt Home AFB, ID 83648-5000 . . . 1
24WS/CC, APO AA 34001-5000 . . . 1
OL-AA, 5WS, Libby AAF, Ft Huachuca, AZ 85613-6000 . . . 1
ATSI/CDW, US Army Intel, Ft Huachuca AI, AZ 85613-5000 . . . 1
129 ARRS/DOV, NAS Moffett Fld, CA 94035-5006 . . . 1
US Central Comm CCJ3, MacDill AFB, FL 33608-7001 . . . 1
US Spec Op Comm Cent, MacDill AFB, FL 33608-7001 . . . 1
US Spec Op Comm SOJ3, MacDill AFB, FL 33608-7001 . . . 1
Det 1, NEADS/DOW, Bldg 510, Bangor ANGB, ME 04401-3099 . . . 1
101 AREFW/DO, Bangor ANGB, ME 04401-3099 . . . 1

5WS, FCWE/SWO, Bldg 168, Ft McPherson, GA 30300-5000 . . . 1
OL-A, 5WS, AFZJ/SWO, Ft Irwin, CA 92310-3000 . . . 1
Det 1, 5WS, Ft Campbell, KY 42223-5000 . . . 1
Det 2, 5WS, Davison USA Airfield, Ft Belvoir, VA 22060-5746 . . . 1
OL-A, Det 2, 5WS, Tipton USA Airfield, Ft Meade, MD 20755-5295 . . . 1
OL-B, Det 2, 5WS, Ft Indiantown GAP, PA 17003-5002 . . . 1
Det 3, 5WS, Ft Bragg AIN, NC 28307-5000 . . . 1
CDR USASOC, Attn: AOIN-ST, Ft Bragg, NC 28307-5200 . . . 1
JSOC/Weather, P.O. Box 70239, Ft Bragg, NC 28307-5000 . . . 1
Det 4, 5WS, Ft Drum, NY 13602-5042 . . . 1
Det 5, 5WS, Ft Knox, KY 40121-5540 . . . 1
Det 6, 5WS, Bldg 3082, Airport Dr., Ft Lewis, WA 98433-5000 . . . 1
Det 7, 5WS, Ft Ord, CA 93941-5111 . . . 1
Det 8, 5WS, 743 Ray Place, Ft Riley, KS 66442-5317 . . . 1
OL-A, Det 8, 5WS, Ft Leonard Wood, MO 65473-5862 . . . 1
Det 9, 5WS, Ft Rucker, AL 36362-5162 . . . 1
OL-A, Det 9, 5WS, Rt 3, Box 302, Troy, AL 36081-5000 . . . 1
Det 10, 5WS, Ft Benning, GA 31905-6034 . . . 1
75th RGR, Attn: SWO, Ft Benning, GA 31905-5000 . . . 1
Det 11, 5WS, Ft Sill, OK 73503-5100 . . . 1
Det 12, 5WS, Ft Devens, MA 01433-5310 . . . 1
Det 13, 5WS, Ft Eustis, VA 23604-5252 . . . 1
Det 14, 5WS, Ft Hood, TX 76544-5076 . . . 1
OL-A, Det 14, 5WS, Ft Bliss, TX 79916-2418 . . . 1
Det 21, 5WS, Hunter AAF, GA 31409-5193 . . . 1
OL-A, Det 21, 5WS, Ft Stewart, GA 31314-5000 . . . 1
Det 31, 5WS, Ft Polk, LA 71459-6250 . . . 1
Det 58, 5WS, Bldg 9601, Butts AAF, Ft Carson, CO 80913-6403 . . . 1

USAFE/DOW, Unit 3050, Box 15, APO AE 09094-5000 . . . 1
USAFE/DOWO, Unit 3050, Box 500, APO AE 09094-5000 . . . 1
17AF/DOW, Unit 4065, APO AE 09136-5000 . . . 1
Det 1, 86 OPS GP, Unit 8495, APO AE 09094-5000 . . . 1
OL-A, Det 1, 86 OPS GP, Unit 4070, APO AE 09136-5000 . . . 1
OL-B, Det 1, 86 OPS GP, Unit 4605, APO AE 09260-5000 . . . 1
OL-C, Det 1, 86 OPS GP, Unit 3565, APO AE 09122-5000 . . . 1
OL-D, Det 1, 86 OPS GP, Unit 7890, APO AE 09122-5000 . . . 1
OL-B, 86WS, Unit 4605, APO AE 09260-5000 . . . 1
HQ EUCOM ECJ3/WE, Unit 30400, Box 1000, APO AE 09128-4209 . . . 1
513 ACCW/DOW, APO AE 09459-5000 . . . 1
48 OSS/WX, Unit 8300, APO AE 09464-5000 . . . 1
86WS, Unit 3090, APO AE 09136-5000 . . . 1
OL-A, 86WS, APO AE 09719-5000 . . . 1
36 FW/DOM, Unit 3860, APO AE 09132-5000 . . . 1

Det 13, 86WS, Unit 7890, APO AE 09122-5000 1

7WS, CINCUSAREUR/AREAWX, APO AE 09403-5000 1
7WS, Unit 29351, APO AE 09014-5000 1
OL-C, 7WS, Cmr 445, Box 260, APO AE 09046 1
OL-D, 7WS, Unit 23631, APO AE 09189-2764 1
OL-E, 7WS, APO AE, 09137-5708 1
OL-F, 7WS, Unit 31401, Box 6, APO AE 09630-5000 1
OL-G, 7WS, Unit 22648, APO AE 09272-5000 1
OL-I, 7WS, Unit 26703, APO AE 09235-5000 1
OL-J, 7WS, C/O CDR 431 AADCOM, Attn: G2 Weather,
APO AE 09175-6321 1
Det 1, 7WS, Unit 27210, APO AE 09092-0216 1
Det 2, 7WS, Unit 20200, APO AE 09165-9816 1
Det 3, 7WS, Unit [illegible]1, APO AE 09102-3737 1
Det 4, 7WS, Unit [illegible]020, APO AE 09025-0251 1
Det 5, 7WS, Cmr 454, APO AE 09250-0047 1
Det 6, 7WS, Cmr 453, APO AE 09146-0979 1
Det 7, 7WS, Unit 28130, APO AE 09114-5000 1
OL-A, Det 7, 7WS, Unit 28216, APO AE 09173-5000 1
Det 8, 7WS, Unit 25202, APO AE 09079-5000 1
Det 9, 7WS, Cmr 423, APO AE 09107-0200 1
Det 9, 7WS, Cmr 422, APO AE 09274-5000 1
Det 10, 7WS, Unit 26410, APO AE 09182-0006 1
OL-B, Det 10, 7WS, APO AE 09031-5000 1
Det 12, 7WS, Unit 24220, APO AE 09185-5000 1
OL-A, Det 12, 7WS, APO AE 09111-5000 1
Det 13, 7WS, Cmr 416, APO AE 09140-9998 1
Det 26, 7WS, Unit 29632, APO AE 09096-5000 1
3AF/DOW, Unit 4838, APO AE 09459-5000 1
435 TAW/WXF, APO AE 09097-5000 1
81 FW/WE, Unit 6105, APO AE 09497-5000 1
20 FW/DOM, Unit 5475, APO AE 09466-5000 1
Det 17, 28WS, APO AE 09456-5000 1
10 FW/DOM, PSC 47, APO AE 09470-5000 1
OL-A, 31WS, Unit 6795, APO AE 09719-5000 1
32TFG/DOM, Unit 6795, APO AE 09719-5000 1
86WF, Unit 3090, APO AE 09094-5000 1
40 TSW/WE, Unit 616, APO AE 09601-5000 1
52 OSS/WEF, Unit 3680, Box 195, APO AE 09126-5000 1
16AF/SWO, Unit 6365, APO AE 09641-5000 1
401 CSG/WE, Unit 6490, APO AE 09641-5000 1
406 TFTW/WE, Unit 7940, APO AE 09646-5000 1
39 TACG/DOM, Unit 7090, PSC 115, APO AE 09824-5000 1
52TFW/OTM, APO AE 09705-5000 1
OL-A, Det 6, 2WW, APO AE 09050-5000 1
HQ 3AF/DOW, APO AE 09459-5000 1

48 Weather Flight, APO AE 09464-5000 1
101 Weather Flight, Otis ANGB, MA 02542-5001 1
104 Weather Flight, Bldg P 929, Ft Meade, MD 20755-5430 1
105 Weather Flight, Smyrna APT, TN 37167-2091 1
107 Weather Flight, Selfridge ANGB, MI 48045-5024 1
110 Weather Flight, 131TFW, Bridgeton, MO 63044-2371 1
111 Weather Flight, Ellington ANGB, TX 77034-5586 1
113 Weather Flight, Hulman Fld, Terre Haute, IN 47830-5000 1
116 Weather Flight, Bldg 304, McChord AFB, WA 98433-5000 1
119 Weather Flight, McGuire AFB, NJ 08641-6004 1
120 Weather Flight, Buckley ANGB, CO 80011-9599 1
121 Weather Flight, Andrews AFB, MD 20331-6539 1
122 Weather Flight, New Orleans NAS, LA 70143-0200 1
123 Weather Flight, Portland IAP, OR 97218-2797 1
125 Weather Flight, PO Box 580340, Tulsa AFS, OK 74158-0340 1
126 Weather Flight, 350 E College, Milwukee, WI 53207-6298 1
127 Weather Flight, Forbes Fld, Topeka, KS 66619-5000 1
130 Weather Flight, Yeager Apt, Charleston, WV 25311-5000 1
131 Weather Flight, Barnes Map, Westfield, MA 01085-1385 1
140 Weather Flight, Willow Grove NAS, PA 19090-5105 1
146 Weather Flight, GTR Pittsburg ANG AN, PA 15231-0459 1
154 Weather Flight, Camp Robinson, North Little Rock, AR 72118-2200 1
156 We[illegible] Flight, 5225 Morris Fld Dr., Charlotte, NC 28208-5797 1
163 W[illegible] light, Ft Wayne Muni Apt, IN 46809-5000 1
164 W[illegible] light, Rickenbacker ANGB, OH 43217-5007 1
165 W[illegible] light, Standiford Fld, Louisville, KY 40213-2678 1
181 We[illegible] Flight, 8150 W Jefferson Blv, Dallas, TX 75211 9570 1
182 Weather Flight, Kelly AFB, TX 78241-7001 1
195 Weather Flight, 8030 Balboa Blvd, Van Nuys, CA 91406-1195 1
199 Weather Flight, Wheeler AFB, HI 96854-5000 1
201 Weather Flight, Suffolk CO ANGB, NY 11978-1294 1
202 Weather Flight, Otis AFB, MA 02542-5001 1
203 Weather Flight, Ft Indiantown GAP, Annville, PA 17003-5002 1
204 Weather Flight, McGuire AFB, NJ 08641-6004 1
207 Weather Flight, RR2, Box 124, Shelbyville, IN 46176-4914 1
208 Weather Flight, 206 Airport DE, St Paul, MN 55107-4098 1
209 Weather Flight, PO Box 5218, Austin, TX 78763-5218 1
210 Weather Flight, Ontario ANGB, CA 91761-7627 1

COMNAVOCEANCOM, Code N312, Stennis Space Ctr, MS
39529-5000 2
COMNAVOCEANCOM (Capt Brown, Code N332), Stennis Space Ctr,
MS 39529-5001 1
NAVOCEANO (Rusty Russum), Stennis Space Ctr, MS 39522-5001 2
NAVOCEANO, Code 9220 (Tony Ortolano), Stennis Space Ctr, MS
39529-5001 1
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NOARL West, Monterey, CA 93943-5006 1
Naval Research Laboratory, Code 4323, Washington, DC 20375 1
Naval Postgraduate School, Chmn, Dept of Meteorology, Code 63,
Monterey, CA 93943-5000 1
Naval Eastern Oceanography Ctr (Clim Section), U117 McCAdy Bldg,
Norfolk NAS, Norfolk, VA 23511-5000 1
Naval Western Oceanography Ctr, Box 113, Attn: Tech Library, Pearl
Harbor, HI 96860-5000 1
Naval Oceanography Command Ctr, COMNAVMAR Box 12, FPO San
Francisco, CA 96630-5000 1
Naval Oceanography Command Ctr, Box 31, USNAVSTA FPO New York,
NY 09540-3000 1
NAVOCEANCOMDET, Federal Building, Asheville, NC 28801-2696 1
NAVOCEANCOMDET, Patuxent River NAS, MD 20670-5103 1
NAVOCEANCOMFAC, NAS North Island, San Diego, CA 92135-5130 1
Naval Air Warfare Center-Weapons Division, Geophysical Sciences
Branch, Code 3254, Attn: Mr. Roger Helvey, Point Mugu, CA 93042-5001 1
WSO, H & HS Marine Station Wea, MCAS Tostin CA 92710-5000 1

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